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boundary, to be 3000 feet. This differs considerably from the earlier estimates. (Amer. Geol., 1896.)

Bulletins No. 6 and No. 7, (1895) and No. 8, (1896) of the Illinois State Museum of Natural History contain descriptions of new Paleozoic Echinodermata, by S. A. Miller and Wm. F. E. Gurley. One new family (Thalamocrinidæ) and five new genera (Sampsonocrinus, Emperocrinus, Shumardocrinus, Thalamocrinus, Indianocrinus) are defined. In all, 156 species are described and figured.

MESOZOIC.—According to F. H. Knowlton, the fossil flora of Yellowstone Park represents three distinct stages. The first, or older flora, from the acid rocks embraces 79 forms; the second, or intermediate flora, has 30 species; and the third, or younger flora, comprises 70 forms. The author refers the first stage division to the Ft. Union or lower Eocene; the second is regarded as Miocene, but older than the Auriferous Gravels; and the third is probably of the same age as the Auriferous Gravels of California, that is, Upper Miocene. (Amer. Journ. Sci., July, 1896.)

A new fossil plant, *Salvinia elliptica*, is described and figured by Prof. Hollick. The new species is from the Upper Cretaceous of Washington State. (Bull. Torrey Botan. Club, Vol. 21, 1894.)

BOTANY.¹

Botany at Buffalo.—In August (21 to 28) there were three botanical meetings held in Buffalo, as follows:

The *Botanical Society of America* met on Friday and Saturday in the High School, with eleven members in attendance. C. H. Peck, of Albany, and B. T. Galloway, of Washington, were elected to membership. The question of the desirability of a winter meeting was discussed and referred to the Executive Committee. Appropriate resolutions regarding the death of M. S. Bebb, a member, were adopted. The address of the retiring President, William Trelease, on "Botanical Opportunity," was given in open session on Friday evening. This will be printed in full in *Science* and the *Botanical Gazette*, and will also be distributed in pamphlet form by the Secretary. The following papers were accepted for presentation:

The Philosophy of Species-making. By L. H. Bailey.

¹ Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

Some Characteristics of a Fresh-water Insular Flora. By Conway MacMillan.

Some Problems in Sporophyll Transformation among Dimorphic Ferns. By G. F. Atkinson.

A Species of *Eleocharis* New to North America. By N. L. Britton.

In the election of officers for the ensuing year, the following were chosen: John M. Coulter, Chicago, President; Charles S. Sargent, Brookline, Vice-President; Arthur Hollick, Brooklyn, Treasurer; Charles R. Barnes, Madison, Secretary; Benjamin L. Robinson, Cambridge, and Frederick V. Coville, Washington, Councillors.

The Botanical Section (G) of the American Association for the Advancement of Science. An unusually large number of papers were read before the Section, and it is not too much to say that in point of importance they fully maintained the high average of recent years:

1. The Relation of the Growth of Leaves to the CO₂ of the Air. By D. T. MacDougal.
2. Directive Forces Operative in Leaf Rosettes. By R. N. Day.
3. On *Crataegus coccinea* and its segregates. By N. L. Britton.
4. The Distribution of the species of *Gymnosporangium* in the South. By L. M. Underwood and F. S. Earle.
5. Morphology of the *Canna* Flower. By L. H. Bailey.
6. A Comparison of the Flora of Erie Co., Ohio, with that of Erie Co., New York. By E. L. Moseley.
7. The Significance of Simple and Compound Ovaries. By C. E. Bessey.
8. On the Bacterial Flora of Cheddar Cheese. By H. L. Russell.
9. The Terminology of Reproduction and Reproductive Organs. By C. R. Barnes.
10. A Comparative Study of the Development of some Anthracnoses in Artificial Cultures. By Bertha Stoneman.
11. The Development of Vascular Elements in the Primary Root of Indian Corn. By W. W. Rowlee.
12. Some Remarks on Chalazogamy. By J. M. Coulter.
13. The Habits of the Rarer Ferns of Alabama. By L. M. Underwood.
14. On the Stem Anatomy of Certain *Onagraceae*. By Francis Ramaley.
15. The Point of Divergence of Monocotyledons and Dicotyledons. By C. E. Bessey.
16. Notes on the Pine Inhabiting Species of *Peridermium*. By L. M. Underwood and F. S. Earle.

17. Reaction of Leaves to Continual Rain-Fall. By D. T. MacDougal.

18. Studies in Nuclear Phenomena, and the Development of the Ascospores in Certain *Pyrenomyces*. By Mary A. Nichols.

19. The Stigma and Pollen of *Arisaema*. By W. W. Rowlee.

20. Notes on the Genus *Amelanchier*. By N. L. Britton.

21. Remarks on the Northern Species of *Vitis*. By L. H. Bailey.

22. On the Formation and Distribution of Abnormal Resin Ducts in Conifers. By Alex. P. Anderson.

23. The Development of the Cystocarp of *Griffithsia bornetiana*. By Arma A. Smith.

24. Notes on the Allies of the Sessile *Trillium*. By L. M. Underwood.

25. On an Apparently Undescribed *Cassia* from Mississippi. By C. L. Pollard.

26. A Bacterial Disease of the Squash-Bug (*Anasa tristis*). By B. M. Duggar.

27. What is the Bark? By C. R. Barnes.

28. Embryo-Sac Structures. By J. M. Coulter.

29. Some *Cyperaceæ* New to North America, with Remarks on Other Species. By N. L. Britton.

30. Grasses of Iowa. By L. H. Pammel.

31. Ceres-Pulver: Jensen's New Fungicide for the Treatment of Smut. By W. A. Kellerman.

32. On the Cardamines of the *C. hirsuta* group. By N. L. Britton.

33. The Relation Between the Genera *Polygonella* and *Thysanella*, as Shown by a Hitherto Unobserved Character. By John K. Small.

34. An Apparently Undescribed Species of *Prunus* from Connecticut. By John K. Small.

35. The Flora of the Summits of King's Mountain and Crowder's Mountain, North Carolina. By John K. Small.

36. Parthenogenesis in *Thalictrum fendleri*. By David F. Day.

37. Notes on the Order *Pezizineæ* of Schröter. By Elias J. Durand.

38. What Should Constitute a Type Specimen? By S. M. Tracy.

39. Rheotropism and the Relation of Repose to Stimulus. By F. C. Newcombe.

40. Some Adaptation of Shore Plants to Respiration. By Herman von Schrenk.

41. The Mechanism of Curvature in Tendrils. By D. T. MacDougal.

42. A Contribution to Our Knowledge of Turgor. By E. B. Copeland.

The Botanical Club. This vigorous organization fully justified its existence again. About forty papers were read. Many of these, of course, were notes, but others were of considerable value. Among the more important of these were the following:

The Distribution of *Phoradendron flavescens*, *Polypodium polypodioides* and *Bignonia crucigera* in Ohio. By W. A. Kellerman.

A Method of Distributing Fungi in Pure Cultures. By L. R. Jones.

Notes on Some Mosses. By Mrs. E. G. Britton.

Notes on *Iris*. By David F. Day.

An Improved Paraffin Bath. By F. C. Newcombe.

Notes on Oaks. By W. W. Rowlee.

Some Notes on Potato-Leaf Fungi. By L. R. Jones.

A Method of Preventing Condensation of Water in Culture Dishes. By H. L. Russell.

Notes on the Flora of Colorado Springs, Colorado. By Charles E. Bessey.

On a Species of *Epipactis*. By Elias J. Durand.

A Report Upon the National Herbarium. By C. L. Pollard.

Schizaea pusilla from Newfoundland. By Mrs. E. G. Britton.

Photosyntax vs Photosynthesis. By C. R. Barnes.

The Distribution of *Pinus ponderosa* in Nebraska. By Charles E. Bessey.

Some Curious Sunflowers. By J. F. Cowell.

Notes on Species of *Mnium*. By Mrs. E. G. Britton.

The Canyon Flora of the Plains. By Charles E. Bessey.

The Turgor of Mosses. By E. B. Copeland.

A Simple Apparatus for Spraying and Infecting Plants. By A. P. Anderson.

The Structure of Pseudoparenchyma in Higher Fungi. By Elias J. Durand.

Note on the Hosts of *Comandra umbellata* and *C. pallida*. By Herman von Schrenk.

The Submerged Leaves of *Salvinia natans*. By Conway MacMillan.

Nuclear Budding in *Cypripedium*. By Conway MacMillan.

An Unusual Adaptation of Conifers for Wind Protection. By Conway MacMillan.

Some Plants New to the Rochester Flora. By Florence Beckwith.

The Committee on Nomenclature made a report recommending that :

(1) A list of North American Pteridophyta and Spermatophyta be prepared for publication.

(2) A supplement be prepared to the present List of Pteridophyta and Spermatophyta of the Northeastern United States.

(3) The Rochester-Madison Rules be republished with annotations and explanations.

The officers for the next year are : President, S. M. Tracy, Agricultural College, Miss.; Vice-President, L. R. Jones, Burlington, Vt.; Secretary-Treasurer, E. Burgess, New York.

A New Manual of Systematic Botany.²—It is many years since American botanists have had the pleasure of examining a new manual of systematic botany designed for use in the northeastern States. We have had new editions of old books, but, unfortunately for scientific progress, through a remarkable misconception of the duties of executors, these editions were new mainly in type and binding, the additions and modifications having been purposely reduced to a minimum. It has been a matter of profound regret on the part of many of the friends and admirers of Dr. Gray that his books should receive such a treatment as to prematurely relegate them to the list of antiquated and obsolescent works. A new manual is, therefore, of peculiar interest at the present time, and this interest is enhanced by the fact that it comes from the scientific home of the older botanist, Torrey.

The volume before us is the first of the three volumes which will include descriptions and figures of all the ferns and flowering plants of the northeastern States and Canada. It is in every way a new work—new in its plan, new in its descriptions, new in its illustrations. Volume I opens with an eight-page introduction which is historical and explanatory. Here we learn that more than 4,000 species will be included, and that nearly three-fourths of these will be figured for the first time. Discussions follow on the principles of classification of plants, and the systematic arrangement adopted in the work (Engler and Prantl's). The following quotations are useful and suggestive: "The Nineteenth Century closes with the almost unanimous scientific judgment that the order of nature is an order of evolution and development from the more

² *An Illustrated Flora of the Northern United States, Canada and the British Possessions* from Newfoundland to the Parallel of the Southern Boundary of Virginia, and from the Atlantic Ocean Westward to the 102d Meridian. By Nathaniel Lord Britton, Ph.D., Emeritus Professor of Botany in Columbia University, and Director-in-Chief of the New York Botanical Garden, and Hon. Addison Brown, President of the Torrey Botanical Club. Vol. I, Ophioglossaceae to Aizoaceae. New York: Charles Scribner's Sons. 612 pages, octavo, \$3.00.

simple to the more complex." * * "Systematic arrangement should logically follow the natural order." * * "The sequence of families adopted fifty or seventy-five years ago has become incongruous with our present knowledge, and it has, for some time past, been gradually superseded by truer scientific arrangements in the later works of European authors." "The more simple forms are, in general, distinguished from the more complex, (1) by fewer organs or parts; (2) by the less perfect adaptation of the organs to the purposes they subserve; (3) by the relative degree of development of the more important organs; (4) by the lesser degree of differentiation of the plant body or of its organs; (5) by considerations of antiquity, as indicated by the geological record; (6) by a consideration of the phenomena of embryogeny. Thus, the Pteridophyta, which do not produce seeds and which appeared on the earth in Silurian time, are simpler than the Spermatophyta; the Gymnospermae in which the ovules are borne on the face of a scale, and which are known from the Devonian period onward, are simpler than the Angiospermae, whose ovules are borne in a closed cavity, and which are unknown before the Jurassic."

"In the Angiospermae the simpler types are those whose floral structure is nearest the structure of the branch or stem from which the flower has been metamorphosed, that is to say, in which the parts of the flower (modified leaves) are more nearly separate or distinct from each other, the leaves of any stem or branch being normally separated, while those are the most complex whose floral parts are most united."

"The sequence of families adopted by Engler and Prantl, in 'Natürliche Pflanzenfamilien' above referred to, has been closely followed in this book, in the belief that their system is the most complete and philosophical yet presented. The sequence of genera adopted by them has, for the most part, also been accepted, though this sequence within the family does not attempt to indicate greater or less complexity of organization."

The nomenclature is that of the well-known Rochester-Madison Rules of the Botanical Club of the American Association for the Advancement of Science, and, in order that the student may fully understand the matter, the rules are printed in full, with explanatory notes. As this work will at once become the standard botanical manual everywhere in this region for which it is designed, the revised nomenclature will soon be more familiar than the old which it is rapidly superseding.

The work proper opens with the family *Ophioglossaceae*, the lowest of the Pteridophyta, in which one species of *Ophioglossum*, and six of *Botrychium* are described and figured. Then follow *Osmundaceae* (3

species), *Hymenophyllaceae* (1 sp.), *Schizaeaceae* (2 sp.), *Polypodiaceae* (59 sp.), *Marsileaceae* (2 sp.), *Salviniaceae* (2 sp.), *Equisetaceae* (11 sp.), *Lycopodiaceae* (11 sp.), *Selaginellaceae* (3 sp.), and *Isoetaceae* (8 sp.).

The flowering plants, as we have been calling them, are here more correctly called seed-bearing plants (*Spermatophyta*), and are properly divided into two classes—*Gymnospermae* and *Angiospermae*, and the latter into the sub-classes *Monocotyledones* and *Dicotyledones*. As one turns over the pages, reading the full descriptions and comparing them with the excellent illustrations (which are always by the side of the descriptions) the conviction deepens that this book is one of the most important systematic works yet produced in this country. This is well illustrated in the treatment of the sedge and grass families which fill two hundred and sixty-six pages. Any one who has tried to puzzle out the genera and species of grasses and sedges will not have to be told of the great advantage which good figures will give to the student of these difficult families. It is not too much to say that no publication hitherto made has done so much to popularize the study of these plants as the one now before us. Of *Carex* alone two hundred and five species are figured!

We have not the space at our command to speak of the many changes in generic and specific limits with which this work will familiarize us. Nearly all of these have been known to specialists and those who have kept their eyes on the work of the German systematists, but to many the changes will come as novelties.

Among the minor matters may be mentioned the abandonment of the absurdity of calling families "orders," thus conforming to the usage in other departments of biological science. All family names (with a very few exceptions) are now made to end in *aceae*, a commendable practice which Dr. Gray used to insist upon. Throughout the work all diphthongs are printed in separate letters (*ae*, *oe*), and not in single characters (*æ*, *œ*), thus again conforming to the German usage. In the rules for pronunciation, a little easement is made for the use of the Roman pronunciation of botanical names, which we wish had been made a little more evident. We regret to see the use of feet, inches and lines still adhered to in this otherwise modern work. The metric units are so generally used in scientific books everywhere that we are surprised at this unexpected anachronism.

As we carefully study the beautifully-printed pages of this work, we are more and more impressed with its magnitude and importance. It will give renewed life and vigor to systematic botany, and doubtless will be the means by which many a student will be led to the study of

the more difficult families. It is so valuable in so many ways that we wish it would be made available to a greater number of students. We venture to suggest to authors and publishers that they bring out an edition *without the illustrations*, and printed on thin paper, with narrow margins. A single volume, portable edition of this admirable book, would greatly extend its usefulness.—CHARLES E. BESSEY.

ZOOLOGY.

The Heart of Some Lungless Salamanders.¹—The recent literature of zoology has, perhaps, contained nothing more unexpected and startling than that certain adult salamanders are entirely lacking in those respiratory organs which, heretofore, have been deemed indispensable to the existence of animals so high in the zoological scale as the Amphibia. This total lack of lungs and branchiæ appears the more marvelous when we remember that they are absent in forms which lead a rather active and wholly terrestrial life, as well as in those of more or less purely aquatic habits.

Two questions are naturally suggested by this apparently aberrant condition of the respiratory organs. First, what structures or organs have taken on the functions of the lungs and branchiæ? and secondly, is there any modification in the form or structure of the heart which in any way may be correlated with the above mentioned peculiarities of these lungless forms?

The first of these two questions has been discussed to some extent by Prof. Harris H. Wilder, of Smith College, who first published an account of this apparently anomalous condition. He concluded that respiration was probably carried on by the skin and, perhaps, to some extent, by the mucosa of the intestine. Prof. Camerano has also published the results of some experiments upon two European forms which bear upon this same question. He believes that in these lungless forms respiration is effected in the bucco-pharyngeal cavity, and that the skin affords no efficient aid in the respiratory processes.

In a still later paper he discusses the subject further, and tries to account for the disappearance of the lungs. Of one aquatic species (of the genus *Molge*) he says: "The function of the lungs as hydrostatic organs, is very marked." "In the clearly terrestrial forms one would say that the diminution in importance of the function of the lungs as hydrostatic organs induces a retrogressive development of them while

¹ Read before the Amer. Assoc. Adv. Science, Aug. 24, 1896.